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A BRIEF HISTORY OF MARITIME MEDICINE

From Prehistory to the Modern Age

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A Brief History of Maritime Medicine

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First Edition — 2026

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This book is a work of historical interpretation intended for educational purposes. It does not provide medical advice for individual cases. Ancient and early-modern medical ideas are discussed as historical systems, not as treatment recommendations.

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About the Author



George Ebraliidze, MD is a European-licensed physician specializing in maritime and expedition medicine. He has worked as a ship's doctor across international waters and as an expedition physician in remote and extreme environments — settings where the gap between clinical decision and definitive care is measured not in minutes but in hours or days. His clinical interests include medical decision-making under resource constraint, protective documentation, and the operational dimensions of care at sea. The questions that drive his work — how does isolation change medicine, and what does a clinician actually do when help is over the horizon — are not academic for him. They are the questions of his working life.

This book was written not to catalogue the past, but to make it useful for the present. The history of maritime medicine is, among other things, a long record of what works when very little is available. That record deserves to be read.

Preface to the First Edition

Maritime medicine is often described as if it began with licensed ship's surgeons, quarantine certificates, and the bureaucratic machinery of the modern state. That is too narrow. The clinical problems of the sea are older than the professions that later named them. The first maritime patient may have been a paddler with a torn palm, a child dehydrating in a dugout, or a labourer carried ashore from a river craft with a fractured limb. Before there were medical institutions at sea, there were maritime decisions with medical consequences.

This book therefore takes a deliberately long view. It begins in prehistory, where evidence is fragmentary and must be handled with caution. It then moves through river civilisations, the classical Mediterranean, the port regimes of plague, the provisioning revolutions of the age of sail, the sanitary engineering of the steamship era, and the telemedical and expeditionary problems of the present.

The argument running through all of these periods is simple: distance changes medicine. Isolation compresses time, magnifies small failures, and turns logistics into clinical care by other means.

The history offered here is not a catalogue of curiosities. It is a history of practical constraints, institutional responses, and changing ways of understanding risk. A ship is not merely a vehicle; it is an environment that creates its own pathology. Water can heal by cleaning or kill by immersion. Food is nutrition, morale, and policy. Fire is warmth, sterilisation, and survival.

This first edition is written as a readable historical synthesis rather than a technical manual. Where the evidence is strong, I state it directly. Where the record is debated — especially in prehistory and antiquity — I mark it as inference or bounded possibility. References are included not to overload the reader, but to make the argument traceable.

Introduction: Why the Sea Changes Medicine

On land, illness usually unfolds within a web of support: shelter, roads, nearby labour, and the expectation that help can be summoned. At sea, that assumption fails. A trivial injury may threaten the function of a crew. A fever becomes dangerous because evacuation is delayed. A contaminated water supply is no longer a nuisance but a voyage-wide system failure. Maritime medicine begins wherever help is over the horizon and the environment itself becomes an active participant in disease, injury, and recovery.

The long history of maritime medicine can be read through a recurring set of questions. How does a society carry the sick when movement is indispensable? How does it provision water, heat, and food under confinement? How does it distinguish between an individual case and a danger to the whole vessel or port? How does it move from informal practical wisdom to written protocols, then from local custom to law? Those questions recur in canoes, galleys, pilgrim ships, steamers, submarines, offshore platforms, and expedition vessels alike.

This is also a history of scale. At first, the problems are intimate: keeping one injured paddler functional, landing safely, preserving a fire, drying clothing. Later, the scale expands to fleets, empires, migration streams, naval wars, and passenger vessels carrying thousands. Yet the old logic never disappears. Even the most advanced shipboard clinic still works inside the same ancient triangle: distance, confinement, and exposure. The tools have changed; the governing conditions have not.

For that reason, the chapters that follow combine narrative history with operational interpretation. Quarantine persisted because ports needed time. Citrus policy mattered because provisioning was physiology. Radio medicine mattered because distance had to be defeated by communication before it could be defeated by transport.

Part I. Deep Origins and Prehistory: Medicine Before Doctors

(c. 70,000 BCE – 3000 BCE)

Part I matters because it breaks the habit of beginning history only when documents appear. Maritime medicine is older than text. The first people who trusted water enough to cross it also discovered that the sea turns minor weakness into existential threat. In that setting, care begins not with specialised titles but with roles, memory, and practical discipline. One member knows how to keep a flame alive. Another recognises when a wounded paddler can still contribute. Another notices when thirst is becoming cognitive decline. This is medicine before doctrine, but not before intelligence.

A lesser-known consequence of studying the prehistoric horizon is methodological humility. Archaeology can prove a crossing more easily than it can prove the treatment of an injury. Yet the consequences of crossing let us reason carefully about likely problems: immersion, dehydration, infection in wet conditions, panic, and the need to preserve group cohesion. Those consequences are not imaginative embellishments; they are the operational costs of committing to water travel.



Seen from later centuries, prehistory also reveals something surprisingly modern: the environment does not merely surround maritime medicine, it co-produces it. The sea sets the tempo. Weather narrows options. Distance makes logistics clinical. That structural lesson will recur in every later period of this book. Maritime medicine did not begin with ships' surgeons, Admiralty regulations, or the age of steam. It began the first time a human group committed to water as a route rather than a boundary. A short crossing changes what 'health' means. A sprained ankle becomes a strategic problem. A fever becomes a clock. Cold water makes minutes decisive. Salt ruins bandages.

Chapter 1. Coasts, Canoes, and the First Sea Crossings

(c. 70,000 – 10,000 BCE)

Vignette

A low swell lifts the canoe as it clears the protection of the reef. The shoreline shrinks into a thin, dark ribbon. No one speaks. The paddlers have already accepted that there will be no help if something goes wrong. A cut on the hand that would be trivial on land now threatens grip. A child's diarrhoea becomes dangerous dehydration. An unexpected squall can turn a crossing into a mass-casualty event. In this earliest phase of maritime life, the sea is not a backdrop — it is the clinical setting.

This is the first rule of maritime medicine: the environment is an active agent. It injures, it infects, it exhausts, and it isolates. Every later institution — quarantine, port health, shipboard clinics, trauma systems — grows out of this simple fact.

What archaeology can and cannot prove

For the deep past, maritime medicine must be reconstructed indirectly. We do not have logbooks or sickbays. Instead, we have anchor observations: stone tools on islands separated by deep water, occupation layers on coastlines that required repeated crossings, and the downstream consequences of voyaging [1,2,3]. The Wallacea–Sahul corridor is central because it requires dispersal through an island zone separated by deep water. At Madjedbebe in northern Australia, securely dated occupation layers place modern humans in Sahul around 65,000 years ago [2]. In the Mediterranean, islands such as Crete and Cyprus provide a second lens [4,5].

Were there 'doctors' this early?

Not in the later sense of a licensed professional. But it is unlikely that early voyaging groups were equal in care. Even small bands tend to develop role differentiation: the person who can set a dislocation, the person trusted to cut and clean a wound, the person who keeps embers alive, the person who recognises dangerous weakness from diarrhoea or fever. One useful framework is the concept of the 'minimum viable crew': beyond paddling skill, a group needs at least one member who can keep people warm, control bleeding, and prevent panic from fragmenting the boat.

The first 'protocols'

Before written rules, maritime medicine is a bundle of practical constraints. Five are constant:

- Warmth: hypothermia is rapid after capsizing; shelter and fire become therapies
- Water: dehydration limits endurance and cognition; safe water is a strategy
- Wounds: salt and wet fibres complicate healing; cutting tools double as surgical instruments
- Infection: once a wound suppurates at sea, margins narrow sharply
- Navigation and cohesion: losing direction or group unity turns illness into catastrophe

Key takeaways

- Maritime medicine begins as constraint management, not theory
- The sea makes small injuries strategically important and compresses time to act
- Early crossings imply organised groups with basic care roles and rescue norms
- Ports and ship clinics are late answers to an ancient question: how do you keep people alive when help is over the horizon?

Chapter 2. Fire, Water, and Wounds: Proto-Protocols on the Move (c. 70,000 – 5,000 BCE)

Vignette

The shore is still out of reach when the first cramps start. A child vomits into the bilge water. The paddlers keep rhythm anyway, because stopping means drifting. On land, sickness can be waited out. On water, the same symptoms threaten navigation, strength, and coordination. Maritime medicine begins as the art of keeping a group functional while the environment tries to separate and exhaust it.

Water as treatment and as threat

Fresh water is the oldest maritime supply problem. Once away from a river mouth, dehydration is no longer a future issue — it is a present limiter. In hot climates it degrades judgement before it causes collapse, increasing the chance of capsizing and navigational error. The simplest medical intervention is therefore logistical: carry water, choose crossing windows, and plan landfall near reliable sources. Even today, expedition medicine treats water planning as first-line prevention; the logic is ancient [7].

Fire and the invention of safe heat

Fire is not just comfort. It is a drying rack for clothing and bandages, a steriliser by boiling, a disinfectant by smoke, and an antidote to cold shock. The ability to keep embers alive through a journey may be one of the earliest medical skills — because without warmth, every other plan fails. Fire also makes water safer. Boiling reduces enteric disease risk when people are forced to drink from unfamiliar sources.

Wounds, salt, and the problem of wet healing

Coastal travel increases exposure to sharp shell, fish spines, coral, and stone. A small cut in a wet, salty environment macerates rapidly, and an infected hand can end paddling capacity. In the absence of antibiotics, wound management is largely mechanical: cleaning, drying, reducing friction, and preventing re-injury. Plant materials available on coastlines and islands — mosses, certain barks, resins — may have served as the earliest wound coverings. This kind of empirical pharmacology is the oldest form of medical knowledge, predating any written

tradition by tens of thousands of years.

Key takeaways

- Dehydration is the oldest maritime enemy; water planning is medical intervention
- Fire provides warmth, drying, sterilisation, and morale
- Wound care at sea is largely mechanical and preventive — clean, dry, protect
- Skin protection from sun and salt is among the oldest preventive maritime practices

Chapter 3. Islands as Laboratories: Crete, Cyprus, and the Problem of Proof

(c. 130,000 – 5,000 BCE)

Islands function like controlled experiments in human survival. They intensify risk: limited freshwater, restricted food options, and no easy retreat. Lithic scatters in the Plakias region of Crete have been used to argue for early crossings [4]. Whatever the exact age, the act of reaching the island implies a 'medical interval' in which evacuation is impossible and prevention dominates.

There is a reason that quarantine chose islands. The lazaretto of Venice, the isolation stations of later centuries, and the hospital ships of naval warfare all share the logic of the prehistoric island: separation, observation, and the conversion of geography into a medical tool. The island teaches maritime medicine its most fundamental lesson — that containment, when evacuation is impossible, is not failure. It is strategy.

Key takeaways

- Islands magnify the consequences of illness, dehydration, and injury by removing the option of evacuation
- Reaching an island implies a medical interval — a period where all care must use only available resources
- The prehistoric island is the conceptual ancestor of the lazaretto, the hospital ship, and the offshore clinic

Chapter 4. Before Physicians: Care Roles and the Social Technology of Survival

(c. 40,000 – 5,000 BCE)

Long before medicine had schools, it had specialists. A group that crosses water repeatedly cannot afford to treat care as optional. Someone must recognise danger early, stabilise injury, preserve warmth, and decide when to stop. This does not require formal doctrine. It requires pattern recognition — who is fading, who is confused, who can still paddle, who cannot. In that sense, maritime medicine is older than writing: it is a social technology for survival under constraint.

One underappreciated dimension of early maritime medicine is psychological. Panic is a clinical event: it wastes heat, burns energy, disrupts coordination, and can capsize a boat. The ability to keep a group calm during a medical emergency is therefore not a soft skill — it is a survival competency.

Before writing, medical knowledge was carried in people. The knowledge keeper is the ancestor of the ship's surgeon, the offshore medic, and the expedition physician. The role has always been the same: carry the knowledge that the environment makes necessary, and be ready to use it when the environment demands it.

Key takeaways

- Care roles existed long before formal medical professions
- Maritime settings reward quiet skills and group discipline
- Psychological stability is a medical asset at sea

Chapter 5. The First Boats and the Birth of Maritime Logistics

(c. 10,000 BCE – 3,000 BCE)

The step from crossing water to living with boats is a turning point. When a boat becomes routine equipment, the sea stops being only a risk and becomes an artery. Planning is the hidden engine of maritime medicine. Once voyages are planned, you can plan water, plan warmth, and plan what to do when someone is injured. You can also standardise: the same cordage, the same way to keep fire, the same knowledge of which bays are safe for landfall.

As boating becomes routine, a subtle change occurs: the community begins to expect rescue. This expectation is the ancestor of later maritime obligations: assisting vessels in distress, organised lifeboats, and rescue services. A society that rescues must also treat.

Key takeaways

- Routine boats create routine maritime risk — and routine medical response
- Rescue norms create survivors; survivors create sustained care needs
- Planning and logistics are the hidden engines of maritime medicine

Part II. Antiquity: Rivers, Ports, and the First Maritime Systems

(c. 3000 BCE – 500 CE)

Part II shows that maritime medicine becomes easier to see once states, texts, and urban institutions enter the picture. Rivers and seas connect medicine to administration. A sick traveller is no longer only a burden to companions; he becomes a problem for a harbour, a temple, a military command, or a city. Antiquity also demonstrates that explanation matters. Greek environmental reasoning, Roman administrative discipline, Byzantine continuity, and Islamic scholarly circulation differ in theory and social setting, yet all attempt to reduce uncertainty in mobile worlds.

Chapter 6. Egypt, Phoenicia, and the First Maritime Trade Networks

(c. 3000–500 BCE)

Vignette

An Egyptian vessel returns to the port of Wadi Gawasis after a voyage to the land of Punt — modern-day Somalia or Eritrea — carrying myrrh, ebony, and living trees. The journey has taken months. Several sailors have fever. One has a wound on his leg that has not healed since a loading accident on the Red Sea coast. The ship's scribe records the cargo. Nobody records the sick. But the sick are there, and someone has been managing them — because the ship came back.

Egypt: the earliest organised maritime medicine



Egypt is among the earliest civilisations known to have organised maritime expeditions at state level. The expeditions to Punt, documented from the Old Kingdom period (c. 2500 BCE) onwards, involved fleets of ocean-going vessels, large crews, and months at sea on the Red Sea [14,23]. The Edwin Smith Papyrus (c. 1600 BCE, but likely copied from older sources) describes systematic examination of wounds, rational assessment of outcomes, and a clear distinction between treatable and untreatable injuries [21]. The Ebers Papyrus documents pharmacological knowledge of considerable breadth.

Phoenicia: medicine carried by trade

The Phoenicians, operating from city-states such as Tyre, Sidon, and Byblos from roughly 1200 BCE onwards, became the dominant maritime traders of the ancient Mediterranean. Their ships reached Spain, North Africa, and possibly beyond the Pillars of Hercules. The Phoenicians also carried goods that mattered medically: cedar resin for wound care, wine for disinfection and morale, olive oil for skin protection, and the spice and herb trade that connected Mediterranean pharmacology to Near Eastern sources. Their ships were, in a limited sense, floating pharmacies before the concept existed.

The Bronze Age maritime world and collapse



The eastern Mediterranean Bronze Age (c. 1600–1200 BCE) was a connected world of palace economies, long-distance trade, and regular maritime contact between Egypt, the Levant, Cyprus, the Aegean, and Anatolia. The Uluburun shipwreck provides a remarkable snapshot: a single vessel carrying copper ingots, tin, glass, ebony, ivory, and plant-based materials from at least seven distinct cultural origins [22]. This connected world also meant connected disease. Maritime routes that moved tin from Afghanistan and ivory from Africa also moved fevers, intestinal pathogens, and skin conditions across previously separated populations.

Key takeaways

- Egypt organised state-level maritime expeditions as early as 2500 BCE, requiring planned medical logistics
- Phoenician commercial voyages embedded medicine in the economics of healthy crews
- The Bronze Age connected world created connected disease ecologies mediated by maritime routes
- Greek colonisation diffused medical knowledge and created the comparative basis for Hippocratic medicine

Chapter 7. Hippocrates, Greek Medicine, and the Sea

(c. 460–370 BCE)

Greek medicine did not separate the human body from place. In the tradition associated with Hippocrates, health was shaped by airs, waters, seasons, topography, and habits of life [14,18]. For maritime settings this mattered enormously. Winds affected exposure and temperature; stagnant harbour water affected smell, taste, and presumed safety; crowded sleeping spaces altered recovery.

Hippocratic case writing emphasised sequence: onset, crisis, turning point, outcome. At sea, where intervention options were limited, prognosis mattered almost as much as diagnosis. If a man could probably recover with rest, the crew could continue. If he was likely to worsen, the vessel needed an earlier landfall. In that sense prognosis became operational — it shaped navigation, labour allocation, and rationing.

Greek naval warfare created distinctive medical demands. Oarsmen were exposed to repetitive musculoskeletal strain, cramped conditions, dehydration, and exhaustion before battle even began. The Battle of Salamis (480 BCE) and the Peloponnesian War (431–404 BCE) generated casualties at a scale that required organised response, not improvisation.

Key takeaways

- Greek environmental medicine provided a systematic framework for understanding maritime health
- Prognosis became operational: it shaped navigation, labour allocation, and resource rationing
- Naval warfare at scale required organised medical response, not improvisation
- The Hippocratic legacy for maritime medicine is a method, not a set of treatments

Chapter 8. Roman Naval Medicine

(c. 100 BCE – 476 CE)

Rome's fleets made an old truth unmistakable: empires run on transport, and transport runs on bodies.

The Roman medicus was present in the fleet as in the legions. His role was pragmatic rather than theoretical: wound care, the management of fevers, and the maintenance of the rowing complement. He operated within a culture that valued discipline, record-keeping, and systematic supply. The medical chest of a Roman naval vessel would have contained instruments, dressings, and plant-based preparations — a direct ancestor of later ship's medicine chests.

One underappreciated feature of Roman maritime life is the medical meaning of routine labour. Bilge work, hauling, rowing, sail handling, and loading grain were not just occupational tasks; they were injury-producing systems. Maritime medicine developed historically not only from spectacular battles and epidemics, but from repetitive work that damaged hands, backs, joints, skin, and teeth.

Key takeaways

- Roman maritime medicine mattered because Rome scaled transport and therefore scaled medical consequences
- Routine labour injuries are as historically important as battle trauma
- Institutional care and disciplined supply systems became more visible under Roman organisation
- Evacuation remained constrained by the ancient realities of time and weather

Chapter 9. Byzantine Maritime Medicine

(c. 330–1453 CE)

Byzantine medicine preserved texts, maintained ports, fought naval wars, and linked charity with organised urban care [14]. The Byzantine contribution is best understood as connective tissue. It did not merely conserve inherited knowledge; it re-situated that knowledge inside Christian institutions, imperial logistics, and an eastern Mediterranean world of islands, straits, and contested coasts.

The plague associated with the reign of Justinian (541–542 CE) demonstrated a pattern that would recur: the state could respond to epidemic crisis through quarantine-like measures, restricting movement and separating the sick, even without understanding the mechanism of transmission. The instinct preceded the theory.

Key takeaways

- Byzantium preserved and operationalised inherited medical knowledge in a still-maritime world
- Port-city charity and institutions widened the social geography of care
- The eastern Mediterranean remained a disease corridor as well as a trade corridor

Chapter 10. Islamic Maritime Medicine

(c. 700–1500 CE)

Islamic medical civilisation translated, criticised, and expanded Greek, Persian, and other inherited traditions [13]. The Indian Ocean trade network — linking East Africa, Arabia, the Persian Gulf, coastal India, and ultimately South-East Asia — was one of the most extensive pre-modern commercial systems in existence. Physicians, surgeons, and learned practitioners moved along these routes with merchants and pilgrims. Their knowledge travelled with them, contributing to a genuinely international medical culture.

Ibn Sina (Avicenna, 980–1037 CE), whose Canon of Medicine became a standard reference across the Islamic and later the European world, addressed questions directly relevant to maritime practice: the effects of climate and water on health, the management of fevers, wound care, and the pharmacology of commonly available plant materials.

Key takeaways

- Islamic medicine strengthened the portable and text-based dimension of maritime care
- Indian Ocean and Mediterranean routes formed a medical as well as commercial network
- Shore institutions such as bimaristans changed the medical value of safe harbour
- The history of maritime medicine is broader than the Atlantic and broader than Europe

Part III. Ports, Plague, and the Age of Sail

(500 – 1800 CE)

This part marks the emergence of maritime medicine as overtly geopolitical. The port becomes a gate through which danger can pass, and states begin to grasp that medical weakness can become military, commercial, and demographic weakness. Quarantine, provisioning, and voyage management are therefore not side stories to empire and trade; they are part of the machinery that made long-distance systems possible.

Chapter 11. Ports, Plague, and the Invention of Quarantine

(1347–1600)

The port city learned a hard lesson: to protect commerce, it first had to slow it down.



Vignette Ragusa, 1377. A ship arrives from the Levant. The harbour master has seen what arrives from those ports lately. The ship is directed to an anchorage at a distance from the main quay. The crew will wait thirty days before anyone from the vessel sets foot in the city. The harbour master does not know about bacteria. He knows that time and distance, applied systematically, can interrupt whatever it is that travels from sick people to healthy ones. In that knowledge — practical, imperfect, and effective — the history of public health begins.

The Black Death of 1347–1353, which reached Europe via maritime routes from the Black Sea through the Mediterranean ports, killed between a third and a half of Europe's population [10]. The catastrophe forced port authorities to think systematically about maritime arrivals in a way that no previous epidemic had done.

The 1377 measures in Ragusa (modern Dubrovnik) represent the first known systematic application of quarantine to maritime arrivals. Ships from suspect areas were required to wait for thirty days — later extended to forty, giving us the word 'quarantine' from the Italian *quarantina giorni*. The Venetian lazaretto, established in 1423 on the island of Santa Maria di Nazareth, provided not just delay but a purpose-built space for observation, separation, and treatment [10,15].

Ships began to carry bills of health — documents issued by port authorities certifying the health status of the vessel and its origin. This documentary system established a principle that persists in modern maritime practice: the health status of a vessel must be declared and certified.

Key takeaways

- Quarantine was a maritime invention, not a land-based one, born from the catastrophe of the Black Death
- It worked by buying time and separating uncertainty from density
- Architecture and paperwork became medical technologies
- Tensions between commerce and health are as old as quarantine itself

Chapter 12. Exploration Medicine: Atlantic Voyages and the First Global Health Shock

(1492–1700)

Oceanic expansion made the sea a vector not only of trade, but of planetary biological disruption.



Shipboard medicine in this era remained limited, yet the consequences of maritime movement were unprecedented. The crossing itself produced dehydration, malnutrition, trauma, and infection; the arrival could unleash epidemic collapse. The Santa María, which carried Columbus on his 1492 crossing, was approximately 18 metres long. It accommodated some forty men in conditions that modern standards would find unacceptable. Dysentery, typhus, scurvy, and respiratory infections were endemic on long voyages.

Diego Álvarez Chanca, appointed by the Spanish Crown for the second expedition (1493), is one of the earliest maritime physicians whose voice survives directly. His letter to the city of Seville documents the health of the crew, the illnesses encountered in the Caribbean, and the challenge of maintaining a sick population thousands of miles from any European medical support [28]. What makes Chanca historically significant is not heroism but method. He looked, he recorded, and he reported.

Alfred Crosby's concept of the Columbian exchange captures the biological dimension of Atlantic contact [11]. Diseases moved in both directions, but with catastrophically unequal consequences. Smallpox, measles, typhus, and influenza devastated indigenous American populations that had never encountered them. Estimates of population decline in the Americas range from 50 to 90 percent in the most severely affected regions.

Key takeaways

- The Columbian exchange was a planetary health shock mediated by ships
- Ships acted as incubators and bridges for disease
- Prevention failures were as important as treatment failures

- Maritime medicine in this era is morally complex and historically consequential

Chapter 13. Scurvy and the Birth of Preventive Maritime Medicine (1600–1795)

Few diseases did more to teach maritime systems that logistics can be more powerful than heroics.

Vignette

A Royal Navy vessel, somewhere in the South Atlantic, month four of a six-month patrol. The surgeon has been watching it develop for weeks — the fatigue that comes too early, the gums that bleed when a man eats, the old wounds on two sailors that have quietly reopened. He knows what it is. Every experienced naval surgeon knows what it is. What he does not have is citrus. Scurvy is not a mystery in 1740. It is a policy failure.

Scurvy was not simply a nutritional deficiency; historically it was a strategic disaster [8,9]. It weakened crews, prolonged voyages, degraded wound healing, increased vulnerability to infection, and could cripple a ship before battle or landfall. By the sixteenth century, experienced navigators knew empirically that long passages without fresh food produced characteristic symptoms: swollen gums, bleeding, fatigue, reopening of old wounds, and eventual death.

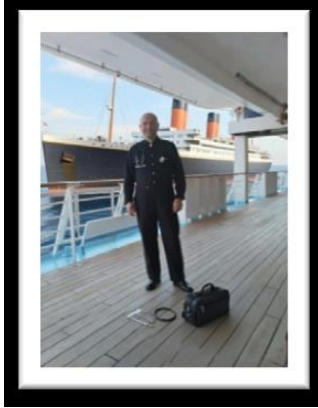
James Lind's 1747 trial aboard HMS Salisbury compared six potential treatments for scurvy in twelve affected sailors, demonstrating the clear superiority of citrus fruit [8]. Yet it was not until 1795 that the Royal Navy formally adopted the regular issue of lemon juice to all sailors. Gilbert Blane played a crucial role in translating Lind's evidence into policy [16]. The lesson is important: in maritime medicine, evidence and policy require intermediaries who understand both.

Key takeaways

- Scurvy transformed maritime medicine by proving that prevention could be systemic
- Lind's work was important, but the gap between evidence and policy required institutional intermediaries
- Provisioning became an explicitly medical question
- The disease helped shift maritime medicine from reactive care to preventive administration

Part IV. Steam, Empire, and Industrial Seas

(1800 – 1945)

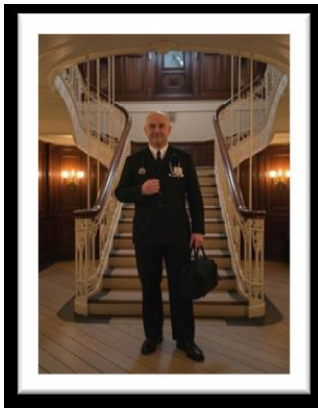


One of the most important historical shifts in this period is that engineering and medicine begin to converge visibly. A badly designed sanitary system can produce more sickness than a poorly trained practitioner can cure. Maritime medicine therefore becomes less romantic and more systemic. The health of a voyage depends on pipes, routines, paperwork, hierarchy, and maintenance as much as on the doctor's knowledge. War at sea intensifies this lesson. Casualty management under industrial conditions requires choreography: movement routes, stations, triage logic, and evacuation chains. Maritime medicine becomes procedural because procedure is one of the few reliable ways to impose order on a violent moving environment.

Chapter 14. From Sail to Steam: Cholera, Migration Ships, and Port Health Engineering

(1817–1900)

Steam did not merely make travel faster; it made crowding, connection, and inspection newly urgent.



Vignette Hamburg, 1892. A steamship arrives from Russia. In the steerage, several passengers have developed severe diarrhoea and vomiting. The crossing has taken twelve days. The ship carries eight hundred emigrants bound for America. The port medical officer chooses observation. Within two weeks, Hamburg has the worst cholera outbreak in European history. Twenty thousand people fall ill. Eight thousand die.

Cholera reached Europe for the first time in 1831–32, travelling along maritime trade routes from India [10]. Four further pandemics crossed the globe during the nineteenth century, each time following shipping lanes. The work of John Snow in London (1854) established the waterborne transmission of cholera [19], but it took decades of epidemiological experience, international sanitary conferences, and regulatory pressure before clean water systems became standard on passenger vessels.

The International Sanitary Regulations of 1892 and 1897 represented the first binding international framework for maritime public health — the direct ancestors of the International Health Regulations that govern maritime disease notification today. Between 1820 and 1930, approximately 50 million Europeans crossed the Atlantic to the Americas. The conditions aboard emigrant steamers varied enormously by class: crowded lower decks, poor ventilation, inferior diet, and restricted access to space meant that class and status structured who became ill and who could recover.

Key takeaways

- Steam intensified maritime medicine by increasing speed, scale, and density
- Cholera made water and sanitation central to maritime public health
- Engineering changes were often as medically important as new theories

- Migration history shows how maritime risk was distributed unequally aboard ship

Chapter 15. War at Sea: Trauma Systems, Burns, and Evacuation (1854–1945)

Naval war repeatedly forced medicine to solve old maritime problems at a brutal new scale.

Vignette

31 May 1916. The North Sea. The Battle of Jutland — the largest naval engagement in history — is underway. HMS Chester has taken multiple hits. Below deck, the ship's medical staff are already overwhelmed. The passageways are dark, filled with smoke and the smell of burning. The medical lesson of that day is not heroism. It is logistics: the evacuation route was blocked, the treatment station was undersized, and the triage doctrine had been rehearsed for a different kind of battle.

A lesser-known truth about naval warfare is that its injuries are not primarily those of open battle. They are the injuries of confinement under violence. Below deck, heat, smoke, toxic combustion products, blast overpressure, and fragmentation combine in spaces designed for machinery and men, not for medicine. The Battle of Jutland tested British naval medicine at a scale it had not previously faced. Fourteen British ships were lost. More than six thousand men died [20].

The legacy of naval warfare for civilian maritime medicine is larger than is usually acknowledged. Structured triage, casualty documentation, burn care protocols, the training of non-medical first responders, improved evacuation planning, and the integration of medical requirements into vessel design — all developed under the pressure of naval necessity and were later absorbed into commercial and passenger shipping.

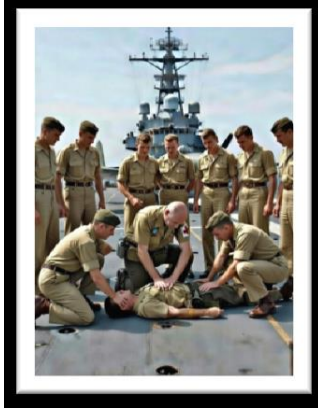
Key takeaways

- Naval warfare forced maritime medicine to become procedural because improvisation under fire is too costly
- Below-deck injuries — burns, blast, smoke inhalation — are historically central and distinctively maritime
- Jutland demonstrated that the first responder aboard a warship is almost never a doctor

- The two World Wars transformed naval medicine through technology and organisation together
- Civilian maritime systems inherited more from wartime necessity than is usually acknowledged

Part V. Modern Maritime Medicine

(1945 – present)



The modern period often imagines itself as having solved maritime isolation through regulation and communication. In truth it has managed, narrowed, and redistributed that isolation. Telemedicine, helicopters, electronic records, and international conventions are profound achievements, but every maritime clinician knows that weather, jurisdiction, and platform limits still have the last word surprisingly often.

Modern maritime medicine is especially revealing because it combines highly advanced expectations with very old constraints. A cruise ship may carry sophisticated equipment and yet still face hours of delay before definitive shore intervention.

Chapter 16. Modern Maritime Medicine: Cruise, Offshore, Telemedicine, and the IMO Era

(1945–2000)

Vignette

Day three of a seven-day Mediterranean cruise. The ship's physician is called at 0330. Forty-seven passengers have reported to the medical centre overnight with acute gastrointestinal illness. The galley has already been flagged. The outbreak team is mobilised. Isolation protocols are activated. Port authorities at the next destination are notified. What is happening on that ship at 0330 is not merely clinical. It is epidemiological, logistical, regulatory, and political simultaneously.

The Maritime Labour Convention (2006) makes explicit what earlier centuries learned through loss — that health protection, medical care, and accident prevention are integral to maritime labour, not optional welfare extras [12]. The Convention sets minimum standards for medical examination of seafarers, the provision of medicines and medical equipment, and access to telemedical assistance.

Telemedical Maritime Assistance Services (TMAS) provide round-the-clock access to specialist medical advice for vessels at sea [17]. They convert distance from an absolute barrier into a managed problem. Yet telemedicine does not abolish maritime constraints; it sharpens the importance of documentation, communication quality, and knowing what resources are actually available onboard.

Key takeaways

- Modern maritime medicine is heavily shaped by regulation, labour rights, and communication systems
- Cruise ship outbreaks demonstrate that the public health logic of quarantine remains operationally relevant
- Offshore practice remains a form of isolated occupational medicine under extreme procedural discipline
- Telemedicine manages distance but does not eliminate it — it sharpens the demand for documentation and communication quality

Chapter 17. The Future of Maritime Medicine: AI, Climate Routes, and the New Isolation

(2000 – present)

The future will add sensors and algorithms. It will not repeal weather, distance, or the need for judgement.



Vignette A container vessel transits the Northern Sea Route — a passage that was largely ice-locked a generation ago. The ship's officer reports a crew member with chest pain and altered consciousness. The nearest shore facility is six hours away by helicopter, in weather that is currently marginal. The TMAS physician has good satellite communication but no imaging and no certainty about what is happening in that chest. The officer asks: should we divert? That question is the oldest question in maritime medicine. The tools are extraordinary. The question is ancient.

AI as assistant, not replacement



Artificial intelligence is being applied to maritime medicine in increasingly concrete ways: decision-support tools that assist clinical diagnosis, predictive analytics identifying crew members at elevated medical risk, and automated documentation systems reducing administrative burden [25]. But maritime medicine teaches a specific caution about technology. AI can support pattern recognition — it cannot replace the judgement of a person who can smell the bilge, feel the ship's motion, and see the patient's face.

Mental health: the underacknowledged crisis

Seafarers face a specific combination of risk factors — prolonged isolation, disrupted family contact, irregular sleep, limited social connection, exposure to traumatic events at sea, and a professional culture that has historically stigmatised distress — that make them particularly vulnerable to depression, anxiety, and suicidal ideation [26,27]. Systematic reviews confirm that seafarers face elevated rates of depression, burnout, and PTSD compared to the general

working population [26]. Suicide rates among merchant seafarers have remained persistently elevated over decades [27].

Key takeaways

- The future of maritime medicine is defined by expanding technological capability meeting expanding geographic reach
- AI can support pattern recognition but cannot replace local judgement in a resource-limited, moving environment
- Arctic and polar routes are creating clinical conditions that resemble expedition medicine rather than commercial shipping
- Mental health is an underacknowledged crisis in contemporary maritime medicine
- History is useful precisely because it reveals how persistent the core maritime problems are — the tools change, the governing conditions do not

Chapter 18. Expedition Medicine: Polar Routes, Remote Evacuation, and Survival Protocols

(Contemporary practice)

Expedition medicine is maritime medicine stripped back to its essentials and then sharpened by remoteness.

Vignette

Day four of an Antarctic Peninsula expedition. The physician is woken at 0200. A team member has fallen on ice during a night watch — suspected ankle fracture, possible head injury, Glasgow Coma Scale 14. Outside: minus eighteen, wind forty knots, visibility zero. The nearest hospital is in Punta Arenas, approximately three hours by air in good conditions. Conditions are not good. The evacuation window, if it opens at all, will not open for at least eighteen hours.



The role of the expedition physician combines clinical competence with operational thinking in a way that few other medical roles require. Medical kit design balances weight against clinical capability. Emergency protocols must be designed for execution by non-medical team members if the physician is incapacitated. Evacuation plans must account for weather windows, helicopter range, and the availability of receiving facilities. All of these tasks require the physician to think like a logistician as well as a clinician. This dual role is not a modern invention — it is the oldest form of maritime medical practice.

Key takeaways

- Expedition medicine revives the oldest maritime logic: logistics, exposure, and time dominate care
- Small clinical problems can become major strategic events in remote settings
- Protocol, calm leadership, and group discipline are medically significant
- The most remote future operations often resemble the deepest past in structure

Epilogue: The Sea Will Always Collect a Price

A ship looks like certainty from shore, but the sea has never been defeated — only negotiated with. Across every era, distance turns small failures into major problems. Maritime medicine has always had a double nature. It is clinical, because bodies suffer. It is operational, because treatment must survive weather, route, hierarchy, and delay. And it is moral, because every voyage raises the question of whose suffering will be anticipated, whose will be ignored, and who will bear the cost of movement.

The long history traced in this book suggests that maritime medicine did not progress in a straight line from superstition to science. Rather, it accumulated layers. Prehistoric rescue norms, classical environmental reasoning, port quarantine, naval provisioning, sanitary engineering, telemedicine, and expedition protocols all persist as nested inheritances. The tools change, but the problem remains recognisable: how to preserve life where the environment is unforgiving and help is late.

The ship's doctor who boards a vessel today inherits all of this: the practical wisdom of the canoe crossing, the environmental reasoning of the Greek physician, the administrative discipline of the Roman fleet, the preventive logic of the scurvy era, the triage doctrine of naval war, and the telemedical reach of the modern era. None of these inheritances is obsolete.

The sea will always collect a price. The history of maritime medicine is the history of how human societies have tried to negotiate the terms.

Appendix A. Selected Timeline of Maritime Medicine

Period	Date Range	Maritime Medical Significance
Deep prehistory	c. 70,000–10,000 BCE	Sea crossings in Wallacea; first maritime care roles
Early Holocene	c. 10,000–3,000 BCE	Routine boat use; rescue norms and sustained care develop
Egypt & Phoenicia	c. 3,000–500 BCE	State expeditions; Edwin Smith Papyrus; Phoenician trade networks
Bronze Age	c. 1,600–1,200 BCE	Connected Mediterranean disease ecologies; first organised maritime logistics
Classical Greece	c. 460–323 BCE	Hippocratic environmental medicine; naval medicine in fleet warfare
Roman Empire	c. 100 BCE–476 CE	Imperial-scale maritime medicine; valetudinaria; organised naval care
Byzantium	c. 330–1000 CE	Preservation of texts; port-city hospitals; Justinianic plague
Medieval Islamic world	c. 700–1500 CE	Medical encyclopaedias; bimaristans; Indian Ocean networks
Black Death & quarantine	1347–1400	Maritime spread of plague; Ragusa ordinances (1377); Venetian lazaretto (1423)
Age of exploration	1492–1700	Columbian exchange; ship as disease incubator; shipboard surgery
Scurvy era	1600–1795	Lind's trial (1747); naval lemon juice policy (1795)
Steam and cholera	1817–1900	Pandemic cholera via maritime routes; sanitary engineering; international health
Naval warfare	1854–1945	Crimean reforms; World War trauma systems; hospital ships; evacuation doctrine
Post-war regulation	1945–2006	ILO conventions; SOLAS medical requirements; telemedicine development
MLC	2006	Binding international standards for seafarer medical care
Contemporary era	2006–present	TMAS; electronic health records; offshore medicine; cruise public health
Emerging future	2020s onwards	Polar operations; AI decision support; climate-adaptive routes; mental health a

Appendix B. Glossary of Recurrent Maritime Medical Concepts

Bimaristan — Hospital institution of the medieval Islamic world; significant as a shore-based reception facility for travellers and seafarers.

Bill of health — Documentary certification of a vessel's health status, issued by port authorities; ancestor of modern health declarations.

Confinement — Restricted space affecting infection dynamics, mental state, and treatment options.

Delay — The interval between the onset of a medical problem and the availability of definitive care; the defining constraint of maritime medicine.

Evacuation window — The period during which weather, sea state, and transport availability permit patient removal from a vessel.

Exposure — The combined physiological effect of cold, heat, wind, spray, and immersion on the human body.

Immersion injury — Harm resulting from entry into or prolonged contact with water; includes hypothermia, aspiration, and drowning.

Isolation — The absence of immediate external help; the fundamental condition of maritime medicine.

Lazaretto — Quarantine facility, typically located on an island or in a dedicated building away from the main port; ancestor of isolation wards.

Logistics — The provision of water, heat, shelter, food, transport, stores, and documentation; the hidden infrastructure of maritime medicine.

Prevention — Provisioning, sanitation, route timing, vaccination, and training; the most cost-effective form of maritime medicine.

Quarantine — The restriction of movement of persons, vessels, or cargo for purposes of disease control.

Rescue norm — The social expectation that persons in danger on water will be assisted; the oldest institutional foundation of maritime medicine.

TMAS — Telemedical Maritime Assistance Service; shore-based specialist medical advisory services for vessels at sea.

Triage — The ordering of patients according to urgency and treatability under conditions of constrained resources.

Valetudinarium — Roman institutional space for the care of sick and wounded soldiers; associated with military camps and fleet facilities.

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Appendix G. Key Figures and Institutions in Maritime Medicine

Hippocrates — Environmental reasoning linked medical practice to place, climate, and water; directly applicable to maritime health.

James Lind (1716–1794) — Conducted the first controlled clinical trial in maritime medicine; demonstrated the efficacy of citrus for scurvy.

Gilbert Blane (1749–1834) — Translated Lind's evidence into naval policy; the decisive intermediary between medical knowledge and institutional reform.

Lazarettos — Institutions that converted space and time into medical tools; the first purpose-built public health infrastructure.

International Labour Organization — Turned basic medical provision from goodwill into enforceable international standards.

Telemedical Maritime Assistance Services (TMAS) — The mature institutional form of medicine stretched across distance.

The ship's doctor — Inherits all layers: clinical, preventive, administrative, diplomatic, logistical. The oldest role in organised maritime medicine is also one of the most demanding in contemporary practice.

Appendix I. Research Pathways for a Wider Maritime Medical History

1. Prehistoric and archaeological — early crossings, island occupation, bioarchaeology of care, environmental reconstruction.
2. Classical and medieval — environmental reasoning, naval organisation, port cities, Indian Ocean networks, Islamic medical transmission.
3. Early modern and imperial — quarantine, long-distance provisioning, slave-ship disease ecologies, migration medicine, naval administration.
4. Industrial and wartime — steam, sanitation engineering, insurance, labour, hospital ships, evacuation doctrine, international health conventions.
5. Contemporary — occupational standards, telemedicine, offshore risk, cruise outbreaks, expedition medicine, climate-linked route change, mental health at sea.

A Note on Illustrations

This book contains two categories of visual material. Photographs of the author — including the portrait in the About the Author section and images depicting the author in clinical and maritime settings throughout the text — are personal photographs reproduced with the author's permission.

The remaining illustrations, including historical and contextual images accompanying chapter content, were created with the assistance of AI image generation tools. These images are intended solely as visual aids to support the historical narrative and do not represent documentary photographs of actual events or persons.

AI Tools Disclosure

In the preparation and production of this work, the author made use of AI-assisted tools for editorial review, text synthesis, and image generation. The historical research, clinical analysis, and intellectual content of this book are the author's own, grounded in the referenced academic and medical literature.

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